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COMPLETE SPECIFICATION

COLLAPSIBLE UMBRELLA WITH REINFORCED RIB STRUCTURE

We, INNOVENTIONS ENTERPRISES LTD, a US company of 1966B Broad Hollow Road, Farmingdale, New York 11735 United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

- 1 -  
(followed by page 1a)

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BACKGROUND OF THE INVENTION

The present invention relates generally to umbrellas, and more particularly, is directed to a collapsible umbrella with a reinforced rib structure.

Compact foldable umbrellas are known which include a telescoping center post with a handle secured to the lower end thereof, the handle being adapted to be grasped by a user to carry the umbrella in its stored configuration and to hold the umbrella in its raised, opened configuration. A stationary hub is secured at the upper end of the center post, with a canopy centrally secured to the stationary hub, and a sleeve is slidably mounted on the telescoping post.

A plurality of equiangularly spaced, radially directed ribs are secured to the canopy in equiangularly spaced relation, each rib having a radially inward end and a radially outward end.

A plurality of strut assemblies are provided, each connected between the sleeve and a respective rib. Each strut assembly includes a first strut having one end pivotally connected at a first pivot point to the sleeve and a second end pivotally connected to a rib at a second pivot point spaced slightly radially outward from the radially inward end of the rib. A second strut has one end pivotally connected at a third pivot point to the stationary hub and a second end pivotally connected at a fourth pivot point to an intermediate point of the first strut, and a third strut has one end pivotally connected at a fifth pivot point to an intermediate point of the second strut and a second end pivotally connected at a sixth pivot point to the respective one of the ribs, the sixth pivot point being positioned radially inward of the second pivot point.

However, a problem with such arrangement is that, during high winds, the forces on the canopy may invert the

canopy, rendering the umbrella useless. Specifically, the first strut will pivot relative to the rib about the second pivot point such that the first strut moves to a position adjacent the sixth pivot point. In such case, there is nothing to stop the inversion of the umbrella. As a result, the first strut continues pivoting upwardly relative to the sleeve about the first pivot point, resulting in inversion of the umbrella.

Although various umbrellas are known which include channels for receiving strut members, these channels are not arranged relative to the ribs with the channel facing toward the ribs in a direction to prevent inversion of the umbrella. As a result, such channels will not prevent an upward inversion of the ribs, for example when the umbrella is subjected to high wind forces.

#### SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an umbrella that overcomes the aforementioned problems with the prior art.

It is another object of the present invention to provide an umbrella which provides improved structural integrity and strength to the umbrella in the open configuration thereof.

It is still another object of the present invention to provide an umbrella in which inversion of the canopy is inhibited.

It is yet another object of the present invention to provide an umbrella which inhibits lateral movement of the ribs.

In accordance with an aspect of the present invention, a foldable umbrella comprises a post; a stationary hub secured to an upper end of said post; at least one canopy centrally secured to said stationary hub; a sleeve slidably

mounted on said post; a plurality of radially oriented ribs secured to said canopy, each said rib having a radially inner end and a radially outward end; and a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs. Each strut assembly includes at least a first strut member having one end portion pivotally connected at a first pivot to said sleeve and a second end portion pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, and a generally U-shaped channel mounted to one of said rib and said first strut member, said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post, said generally U-shaped channel having spaced apart legs extending from said one of said rib and said first strut member so as to engage a portion of the other of said rib and first strut member at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut member at least when said rib is caused to move toward an inverted condition of the umbrella, and wherein said generally U-shaped channel is dimensioned to snugly receive said portion of said other of said rib and first strut member.

In accordance with another aspect of the present invention, a foldable umbrella includes a post; a stationary hub secured to an upper end of the post; at least one canopy centrally secured to the stationary hub; a sleeve slidably mounted on the post; a plurality of radially oriented ribs secured to the canopy, each rib having a radially inner end and a radially outward end; a plurality of foldable strut assemblies, each strut assembly connected between the sleeve and a respective one of the ribs,

each strut assembly including a first strut having one end pivotally connected at a first pivot to the sleeve and a second end pivotally connected to a respective one of the ribs at a second pivot spaced radially outwardly from the radially inner end of the rib, a second strut having one end pivotally connected at a third pivot to the stationary hub and a second end pivotally connected at a fourth pivot to an intermediate point of the first strut, and a third strut having one end pivotally connected at a fifth pivot to an intermediate point of the second strut and a second end pivotally connected at a sixth pivot to the respective one of the ribs, the sixth pivot being positioned radially inward of the second pivot; and a generally U-shaped channel mounted to each rib, said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post, said generally U-shaped channel having spaced apart legs extending from said rib toward said first strut so as to engage a portion of said first strut at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut at least when said rib is caused to move toward an inverted condition of the umbrella, and wherein said generally U-shaped channel is dimensioned to snugly receive said portion of said first strut.

Specifically, a bracket is secured to the radially inner end of each rib, the first strut is pivotally secured to the bracket at the second pivot, and thereby to the rib, the third strut is pivotally secured to the bracket at the sixth pivot, and thereby to the rib, and the U-shaped channel is provided on the bracket at a position between the second and sixth pivots. The U-shaped channel has an open end that extends down in the

open configuration of the umbrella, for receiving the first strut therein, and is dimensioned to snugly receive the first strut therein.

In accordance with still another aspect of the present invention, a foldable umbrella includes a post; a stationary hub secured to an upper end of the post; at least one canopy centrally secured to stationary hub; a sleeve slidably mounted on the post; a plurality of radially oriented ribs secured to the canopy, each rib having a radially inner end and a radially outward end; a plurality of foldable strut assemblies, each strut assembly connected between the sleeve and a respective one of the ribs, each strut assembly including at least a first strut member having one end portion pivotally connected at a first pivot to the sleeve and a second end portion pivotally connected to a respective one of the ribs at a second pivot spaced radially outwardly from the radially inner end of the rib, and a generally U-shaped channel mounted to one of said rib and said first strut member, said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post, and said generally U-shaped channel having spaced apart legs extending from said one of said rib and said first strut member so as to engage a portion of the other of said rib and first strut member at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut member at least when said rib is caused to move toward an inverted condition of the umbrella; and wherein said U-shaped channel is spaced apart from said second pivot with a non-engaging area between said U-shaped channel and said second pivot, said non-engaging area being an area at which said other

of said rib and said first strut member is not engaged or contacted.

In another aspect, the present invention broadly consists in a foldable umbrella comprising: a post; a stationary hub secured to an upper end of said post; at least one canopy centrally secured to said stationary hub; a sleeve slidably mounted on said post; a plurality of radially oriented ribs secured to said canopy, each said rib having a radially inner end and a radially outward end; a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including: a first strut having one end pivotally connected at a first pivot to said sleeve and a second end pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, a second strut having one end pivotally connected at a third pivot to said stationary hub and a second end pivotally connected at a fourth pivot to an intermediate point of said first strut, and a third strut having one end pivotally connected at a fifth pivot to an intermediate point of said second strut and a second end pivotally connected at a sixth pivot to said respective one of said ribs, said sixth pivot being positioned radially inward of said second pivot; and a generally U-shaped channel mounted to each said rib, said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post, said generally U-shaped channel having spaced apart legs extending from said rib toward said first strut so as to engage a portion of said first strut at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to

said first strut at least when said rib is caused to move toward an inverted condition of the umbrella, and wherein said generally U-shaped channel is spaced apart from said second pivot with a non-engaging area between said U-shaped channel and said second pivot, said non-engaging area being an area at which said first strut is not engaged or contacted.

In another aspect, the present invention broadly consists in a folding umbrella comprising: a post; at least one canopy coupled to an upper end portion of said post; a sleeve slidably mounted on said post; a plurality of radially oriented ribs secured to said at least one canopy in equiangularly spaced relation, each said rib having a radially inner end and a radially outward end; a plurality of folding strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including: a first strut having one end portion pivotally connected at a first pivot to said sleeve and a second end portion pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, a second strut having one end portion pivotally connected at a third pivot to said upper end portion of said post and a second end portion pivotally connected at a fourth pivot to an intermediate point of said first strut, and a third strut having one end portion pivotally connected at a fifth pivot to an intermediate point of said second strut and a second end portion pivotally connected at a sixth pivot to said respective one of said ribs, said sixth pivot being positioned radially inward of said second pivot; and at least one of said first through third struts having a substantially U-shaped bend therein for receiving another part of the umbrella in a closed configuration.

of the umbrella so as to enable the umbrella to fold into a more compact configuration.

In another aspect, the present invention broadly consists in a foldable umbrella comprising: a post; at least one canopy coupled to an upper end portion of said post; a sleeve slidably mounted on said post; a plurality of radially oriented ribs secured to said at least one canopy, each said rib having a radially inner end and a radially outward end; and a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including: at least a first strut member having one end portion pivotally connected at a first pivot to said sleeve and a second end portion pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, and a generally U-shaped channel means mounted to one of said rib and said first strut member, for restraining lateral or sideways movement of said rib relative to said first strut member at least when said rib is caused to move toward an inverted condition of the umbrella, said generally U-shaped channel means being at a position near said second pivot and between said second pivot and said post, and said generally U-shaped channel means having spaced apart legs extending from said one of said rib and said first strut member so as to engage a portion of the other of said rib and first strut member at a position near said second pivot and between said second pivot and said post, to thereby restrain said lateral or sideways movement of said rib relative to said first strut member at least when said rib is caused to move toward an inverted condition of the umbrella, and wherein said generally U-shaped channel means is dimensioned to

receive said portion of said other of said rib and first strut member between the legs thereof at least at a position spaced from said second pivot and at least when said rib is caused to move toward an inverted condition of the umbrella.

In another aspect, the present invention broadly consists in a foldable umbrella comprising: a post; at least one canopy coupled to an upper end portion of said post; a sleeve slidably mounted on said post; a plurality of radially oriented ribs secured to said canopy, each said rib having a radially inner end and a radially outward end; a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including: a first strut having one end pivotally connected at a first pivot to said sleeve and a second end pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, a second strut having one end pivotally connected at a third pivot to said upper end portion of said post and a second end pivotally connected at a fourth pivot to an intermediate point of said first strut, and a third strut having one end pivotally connected at a fifth pivot to an intermediate point of said second strut and a second end pivotally connected at a sixth pivot to said respective one of said ribs, said sixth pivot being positioned radially inward of said second pivot; and a generally U-shaped channel means mounted to each said rib, for restraining lateral or sideways movement of said rib relative to said first strut at least when said rib is caused to move toward an inverted condition of the umbrella, said generally U-shaped channel means being at a position near said second pivot and between said second pivot and said post, and said generally U-

shaped channel means having spaced apart legs extending from said rib toward said first strut so as to engage a portion of said first strut at a position near said second pivot and between said second pivot and said post, to thereby restrain said lateral or sideways movement of said rib relative to said first strut at least when said rib is caused to move toward an inverted condition of the umbrella, and wherein said generally U-shaped channel means is dimensioned to receive said portion of said first strut between the legs thereof at least at a position spaced from said second pivot and at least when said rib is caused to move toward an inverted condition of the umbrella.

In another aspect, the present invention broadly consists in a foldable umbrella comprising: a post; at least one canopy coupled to an upper end portion of said post; a sleeve slidably mounted on said post; a plurality of radially oriented ribs secured to said canopy, each said rib having a radially inner end and a radially outward end; and a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including: at least a first strut member having one end portion pivotally connected at a first pivot to said sleeve and a second end portion pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, and a generally U-shaped channel mounted to one of said rib and said first strut member, said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post, and said generally U-shaped channel having spaced apart legs extending from said one of said rib and said first strut member so as to engage a portion of the other of said rib and first strut member at a

position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut member at least when said rib is caused to move toward an inverted condition of the umbrella; and wherein said generally U-shaped channel is spaced apart from said second pivot with a non-engaging area between said generally U-shaped channel and said second pivot, said non-engaging area being an area at which said other of said rib and said first strut member is not engaged or contacted.

In another aspect, the present invention broadly consists in a foldable umbrella comprising: a post; at least one canopy coupled to an upper end portion of said post; a sleeve slidably mounted on said post; a plurality of radially oriented ribs secured to said canopy, each said rib having a radially inner end and a radially outward end; a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including: a first strut having one end pivotally connected at a first pivot to said sleeve and a second end pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, a second strut having one end pivotally connected at a third pivot to said upper end portion of said post and a second end pivotally connected at a fourth pivot to an intermediate point of said first strut, and a third strut having one end pivotally connected at a fifth pivot to an intermediate point of said second strut and a second end pivotally connected at a sixth pivot to said respective one of said ribs, said sixth pivot being positioned radially inward of said second pivot; and a generally U-shaped channel mounted to each said rib, said

generally U-shaped channel being at a position near said second pivot and between said second pivot and said post, said generally U-shaped channel having spaced apart legs extending from said rib toward said first strut so as to engage a portion of said first strut at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut at least when said rib is caused to move toward an inverted condition of the umbrella, and wherein said generally U-shaped channel is spaced apart from said second pivot with a non-engaging area between said U-shaped channel and said second pivot, said non-engaging area being an area at which said first strut is not engaged or contacted.

In another aspect, the present invention broadly consists in a foldable umbrella comprising: a post; at least one canopy coupled to an upper end portion of said post; a sleeve slidably mounted on said post; a plurality of radially oriented ribs secured to said at least one canopy, each said rib having a radially inner end and a radially outward end; and a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including: at least a first strut member having one end portion pivotally connected at a first pivot to said sleeve and a second end portion pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, and a generally U-shaped channel mounted to one of said rib and said first strut member, said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post, said generally U-shaped channel having spaced

apart legs extending from said one of said rib and said first strut member so as to engage a portion of the other of said rib and first strut member at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut member at least when said rib is caused to move toward an inverted condition of the umbrella, and wherein said generally U-shaped channel is dimensioned to receive said portion of said other of said rib and first strut member between the legs thereof at least at a position spaced from said second pivot and at least when said rib is caused to move toward an inverted condition of the umbrella; wherein said generally U-shaped channel is mounted to said first strut member and has an open end that extends upwardly in the open configuration of the umbrella.

In another aspect, the present invention broadly consists in a foldable umbrella comprising: a post; at least one canopy coupled to an upper end portion of said post; a sleeve slidably mounted on said post; a plurality of radially oriented ribs secured to said canopy, each said rib having a radially inner end and a radially outward end; a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including: a first strut having one end pivotally connected at a first pivot to said sleeve and a second end pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, a second strut having one end pivotally connected at a third pivot to said upper end portion of said post and a second end pivotally connected at a fourth pivot to an intermediate point

of said first strut, and a third strut having one end pivotally connected at a fifth pivot to an intermediate point of said second strut and a second end pivotally connected at a sixth pivot to said respective one of said ribs, said sixth pivot being positioned radially inward of said second pivot; and a generally U-shaped channel mounted to each said rib, said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post, said generally U-shaped channel having spaced apart legs extending from said rib toward said first strut so as to engage a portion of said first strut at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut at least when said rib is caused to move toward an inverted condition of the umbrella, and wherein said generally U-shaped channel is dimensioned to receive said portion of said first strut between the legs thereof at least at a position spaced from said second pivot and at least when said rib is caused to move toward an inverted condition of the umbrella; wherein said first strut is bent downwardly adjacent said second pivot to provide a bend therein which is received in said generally U-shaped channel.

In another aspect, the present invention broadly consists in a foldable umbrella comprising: a post; at least one canopy coupled to an upper end portion of said post; a sleeve slidably mounted on said post; a plurality of radially oriented ribs secured to said canopy, each said rib having a radially inner end and a radially outward end; a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly

including: a first strut having one end pivotally connected at a first pivot to said sleeve and a second end pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, a second strut having one end pivotally connected at a third pivot to said upper end portion of said post and a second end pivotally connected at a fourth pivot to an intermediate point of said first strut, and a third strut having one end pivotally connected at a fifth pivot to an intermediate point of said second strut and a second end pivotally connected at a sixth pivot to said respective one of said ribs, said sixth pivot being positioned radially inward of said second pivot; and a generally U-shaped channel mounted to each said rib, said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post, said generally U-shaped channel having spaced apart legs extending from said rib toward said first strut so as to engage a portion of said first strut at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut at least when said rib is caused to move toward an inverted condition of the umbrella, and wherein said generally U-shaped channel is dimensioned to receive said portion of said first strut between the legs thereof at least at a position spaced from said second pivot and at least when said rib is caused to move toward an inverted condition of the umbrella.

5 Preferably, a bracket is secured to the second strut at the intermediate point thereof for pivotally securing the one end of the third strut to the second strut at the fifth pivot point, and wherein the first strut has the substantially U-shaped bend therein adjacent the fourth pivot point, for receiving the bracket in the closed configuration of the umbrellea.

10 The above and other objects, features and advantages of the present invention will become readily apparent from the following detailed description thereof which is to be read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

15 Fig. 1 is an elevational view of an umbrellea according to the present invention;

20 Fig. 2 is a cross-sectional view of a portion of the umbrellea of Fig. 1 in the open configuration of the umbrellea, taken along line 2-2 thereof;

25 Fig. 3A is an enlarged elevational view of the strut assembly of the umbrellea of Fig. 1 in the fully open configuration of the umbrellea;

30 Fig. 3B is an enlarged elevational view of the strut assembly of Fig. 3A in a partially open configuration of the umbrellea;

35 Fig. 3C is an enlarged elevational view of the strut assembly of Fig. 3A in a substantially closed or folded configuration of the umbrellea;

40 Fig. 4 is a cross-sectional view of the strut assembly of Fig. 3A, taken along line 4-4 in Fig. 3A;

45 Fig. 5 is a cross-sectional view of the strut assembly of Fig. 3A, taken along line 5-5 in Fig. 3A;

50 Fig. 6A is an enlarged elevational view of the strut assembly of a modified umbrellea according to the present invention, in the fully open configuration of the umbrellea;

Fig. 6B is an enlarged elevational view of the strut assembly of Fig. 6A in a partially open configuration of the umbrella;

Fig. 6C is an enlarged elevational view of the strut assembly of Fig. 6A in a substantially closed or folded configuration of the umbrella; and

Fig. 7 is a view similar to that of Fig. 3B, but showing a modified embodiment of the present invention.

DETAILED DESCRIPTION

Referring to the drawings in detail, an umbrella 10 according to the present invention includes a telescoping post 12 with a handle 13 secured to the lower end thereof. The manner in which post 12 telescopes is well known in the art, and can be found in any conventional umbrella, such as those sold under the trademark TOTES.

A stationary hub 14 is secured to the upper end of telescoping post 12, and a canopy 16 is centrally secured to stationary hub 14. Canopy 16 can be any conventional canopy, such as that found in umbrellas sold under the trademark TOTES. However, canopy 16 is preferably of the double-canopy vented type disclosed in U.S. Patent Nos. 4,979,534; 5,065,779; 5,368,055; and 5,487,401; and U.S. Design Patent No. 336,982, all to Johnson et al., and the entire contents of which are incorporated herein by reference. A double-canopy vented type, including a lower vented canopy 16a and an upper canopy 16b secured to the lower canopy by elastic 16c or by sewing 16d (see Fig. 1) is preferred due to its windproof characteristic as described in the Johnson et al patents. The vents may be of the type shown in the Johnson et al patents, or it may be a mesh or any other type of vent, which is covered by an upper canopy. The upper canopy can be connected by elastic members as shown in the drawings of the Johnson et al patents or it may

be tacked (sewn) down at spaced apart portions to the lower canopy. Other attachments of the upper canopy can be used, as desired. The invention is described below with generic reference to a canopy, but a double canopy windproof vented umbrella is preferred.

As shown in Fig. 2, a sleeve 18 is slidably mounted on telescoping post 12, and can be releasably locked in position in the open configuration of umbrella 10 by a spring-loaded latch 20, as is conventional. Post 12 has two telescoping post members 12a, 12b, as is conventional, and a handle 13.

A plurality of radially oriented ribs 22 are secured to canopy 16 in equiangularly spaced relation, each rib 22 having a radially inner end 24 and a radially outward end 26. Radially outward ends 26 are secured to the outer periphery of canopy 16 in a conventional manner by means of a tip member, or as shown in the Johnson et al patents identified above, while radially inner end portions 24 are secured to intermediate points of canopy 16. Ribs 22 function to hold canopy 16 in a desired position. A bracket 27 is secured to the radially inner end 24 of each rib 22.

A plurality of strut assemblies 28 are connected between stationary hub 14, sleeve 18 and ribs 22. Specifically, in the embodiment shown, each strut assembly 28 includes a first strut 30 having one end pivotally connected at a first pivot point 32 to sleeve 18 and a second end pivotally connected to a respective rib 22 at a second pivot point 34 or bracket 27. The second pivot point 34 is spaced radially outwardly by a small distance from the radially inner end portion 24 of the respective rib 22. Specifically, second pivot point 34 is formed at a radially outer end of bracket 27.

5        Each strut assembly 28 further includes a second strut 36 having one end pivotally connected at a third pivot point 38 to stationary hub 14 and a second end pivotally connected at a fourth pivot point 40 located at an intermediate portion of first strut 30. In this regard, a bracket 41 is secured to the intermediate portion of first strut 30 to provide such fourth pivot point 40.

10        Each strut assembly 28 also includes a third strut 42 having one end pivotally connected at a fifth pivot point 44 to an intermediate portion of second strut 36 and a second end pivotally connected at a sixth pivot point 46 to the respective rib 22. The sixth pivot point 46 is positioned radially inward of the second pivot point 34. Specifically, sixth pivot point 34 is formed at a radially inner end of bracket 27. A bracket 45 is secured to the intermediate portion of second strut 36 to provide such fourth pivot point 40.

15        Each strut assembly 28 thereby forms a four bar linkage in a generally parallelogram configuration, which is defined by pivot points 34, 40, 44 and 46.

20        The above described arrangement is conventional. However, a problem with such arrangement is that, during high winds, the forces on canopy 16 may tend to invert canopy 16, that is, forcing ribs 22 upward from the position shown in Fig. 2, bending the ribs and rendering the umbrella useless. Specifically, during such inversion, ribs 22 will pivot upwardly relative to first struts 30 about pivot points 34. In a conventional arrangement, due to lateral displacement of ribs 23 relative to respective ribs 30, the respective pivot point 46 will move to a position alongside and even lower than first strut 30, since, in a conventional construction, there is nothing to prevent such movement.

In accordance with one embodiment of the present invention, bracket 27 includes a U-shaped channel portion 48 mounted thereto, and thereby to each rib 22, at a position between second and sixth pivot points 34 and 46. As a result, in the open configuration of umbrella 10, the radially outer end of first strut 30 is engaged within U-shaped channel 48. See Fig. 5. This prevents lateral movement of ribs 22 relative to first struts 30. Further, in the event that an inversion force is applied to ribs 22, U-shaped channel 48 will prevent such inversion.

Specifically, any such inversion force will tend to rotate rib 22 in the counter-clockwise direction of Fig. 2 about pivot point 34. This pivotal movement, however, is opposed by the engagement of first strut 30 within U-shaped channel 48. Accordingly, such inversion of ribs 22 does not occur.

To provide enhanced engagement, the radially outer end of each strut 30 has an enlarged, thicker end 31, as shown in Fig. 4. U-shaped channel 48 is dimensioned to snugly receive enlarged end 31 therein.

Further, in order to ensure that struts 30 are engaged by U-shaped channels 48 during the open configuration of umbrella 10, the radially outer ends of first and third struts 42 are bent downwardly, as at 49 and 50 (Fig. 3B), respectively. Bend 50 results in U-shaped channel 48 being angled downwardly to receive first strut 30 therein, while bend 49 provides that strut 30 is received in U-shaped channel 48. Conventional folding umbrella structures do not have the bends 49 and 50. Bend 50 could be omitted in some cases, if the bend 49 is large enough and/or if U-shaped channel 48 is long (deep) enough to engage first strut 30 when the umbrella is in its open condition.

The bends 49, 50 enable a contact to be maintained between the outermost end portion of first strut 30 and the

end portion of bracket 27, thus improving structural integrity and stability of the rib structures. The various pivots are preferably made using rivets, as shown by 34 and 36 in Fig. 4. Other pivot devices could be used, as is conventional.

The outermost end of first strut 30 could normally be outside of U-shaped channel 48 if it is close enough thereto such that when an inversion force (such as wind) is applied, the first strut 30 will be received in U-shaped channel 48 to prevent inversion.

Referring now to Figs. 6A-6C, a modified strut assembly 28' according to another embodiment of the present invention will now be described in which elements which are the same as those described in regard to the first embodiment of Figs. 1-5 are identified by the same reference numerals, so that a detailed description of such common elements is omitted herein for the sake of brevity.

Strut assembly 28' of Figs. 6A-6C is identical to strut assembly 28 except that the bend 50' is made greater and a small section of first strut 30 is formed with a small bend 60 that is positioned adjacent to bracket 41 and pivot point 40. With this arrangement, umbrella 10 can be closed into a tighter closed configuration by reason of bracket 45 being received within bend 60 as shown in Fig. 6C (partially closed position).

In Fig. 3C, the bends 49, 50 could be varied in length of bent portion, angle, location of bend, etc. (if the U-shaped channel is arranged to engage strut 30) to enable the structure to fold flatter. In Fig. 3C, the bend 50 is shown larger than the bend 50 in the other Figures to achieve such a result.

Fig. 7 shows a modified embodiment of the present invention, similar to the embodiment of Fig. 3B, but wherein

the U-shaped channel member 48' is mounted on the strut 30 and is arranged to engage the bracket 27 portion of the rib 22 when the umbrella is in its fully open condition and/or when the rib 22 is forced upwardly to a direction to tend to invert the canopy. This structure provides similar effects as the U-shaped channel member 48 described in connection with the other embodiments of the invention. The U-shaped channel member of Fig. 7 must be made sufficiently short so that it does not project past the rib 22 or bracket 27 in the upward direction when the umbrella is forced toward an inverted position, so as not to pierce the fabric of the canopy.

While the rib and strut structure is shown as being made of metal, other lighter weight materials such as 15 fiberglass impregnated in synthetic resin, or other plastic materials having sufficient strength, could be used.

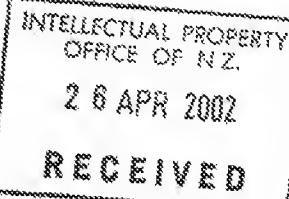
Having described specific preferred embodiments of the invention with reference to the accompanying drawings, it will be appreciated that the present invention is not limited to those precise embodiments and that various changes and modifications can be effected therein by one of ordinary skill in the art without departing from the scope or spirit of the invention defined by the appended claims.

26 APR 2002

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## WHAT I/WE CLAIM IS:

- 1 A foldable umbrella comprising  
a post;  
a stationary hub secured to an upper end of said post,  
at least one canopy centrally secured to said stationary hub,  
a sleeve slidably mounted on said post,  
a plurality of radially oriented ribs secured to said canopy, each said rib having a radially  
inner end and a radially outward end, and  
a plurality of foldable strut assemblies, each strut assembly connected between said  
sleeve and a respective one of said ribs, each strut assembly including  
at least a first strut member having one end portion pivotally connected at a first pivot to  
said sleeve and a second end portion pivotally connected to a respective one of said ribs  
at a second pivot spaced radially outwardly from said radially inner end of the rib, and  
a generally U-shaped channel mounted to one of said rib end and said first strut member,  
said generally U-shaped channel being at a position near said second pivot and between  
said second pivot and said post,  
said generally U-shaped channel having spaced apart legs extending from said one of  
said rib and said first strut member so as to engage a portion of the other of said rib and  
first strut member at a position near said second pivot and between said second pivot  
and said post, to restrain lateral or sideways movement of said rib relative to said first  
strut member at least when said rib is caused to move toward an inverted condition of the  
umbrella, and  
wherein said generally U-shaped channel is dimensioned to snugly receive said portion  
of said other of said rib and first strut member
- 2 A folding umbrella according to claim 1, wherein said generally U-shaped channel is  
mounted to said rib and has an open end that extends down in the open configuration of  
the umbrella, for engaging said first strut member
- 3 A folding umbrella according to claim 1, wherein said generally U-shaped channel is  
arranged to snugly receive said portion of said other of said rib and first strut member  
also when said umbrella is in a normally open configuration
- 4 A folding umbrella according to claim 1, wherein said post is a telescoping post  
including at least two telescoping post members
- 5 A foldable umbrella comprising  
a post;  
a stationary hub secured to an upper end of said post,  
at least one canopy centrally secured to said stationary hub,  
a sleeve slidably mounted on said post,  
a plurality of radially oriented ribs secured to said canopy, each said rib having a radially  
inner end and a radially outward end,  
a plurality of foldable strut assemblies, each strut assembly connected between said  
sleeve and a respective one of said ribs, each strut assembly including  
a first strut having one end pivotally connected at a first pivot to said sleeve and a second  
end pivotally connected to a respective one of said ribs at a second pivot spaced radially  
outwardly from said radially inner end of the rib,  
a second strut having one end pivotally connected at a third pivot to said stationary hub  
and a second end pivotally connected at a fourth pivot to an intermediate point of said  
first strut, and  
a third strut having one end pivotally connected at a fifth pivot to an intermediate point of  
said second strut and a second end pivotally connected at a sixth pivot to said respective  
one of said ribs, said sixth pivot being positioned radially inward of said second pivot, and  
a generally U-shaped channel mounted to each said rib, said generally U-shaped  
channel being at a position near said second pivot and between said second pivot and  
said post,



said generally U-shaped channel having spaced apart legs extending from said rib toward said first strut so as to engage a portion of said first strut at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut at least when said rib is caused to move toward an inverted condition of the umbrella, and wherein said generally U-shaped channel is dimensioned to snugly receive said portion of said first strut

6. The foldable umbrella according to claim 5, wherein said first strut has a generally U-shaped bend portion for receiving the fifth pivot of the umbrella in the U-shaped bend portion in a closed configuration of the umbrella so as to enable the umbrella to fold into a more compact configuration

7. The foldable umbrella according to claim 6, wherein said generally U-shaped bend portion is in the vicinity of where said first strut is connected to a rib.

8. A foldable umbrella according to claim 5, wherein said U-shaped channel is spaced apart from said second pivot with a non-engaging area between said U-shaped channel and said second pivot, said non-engaging area being an area at which said first strut is not engaged or contacted.

9. A foldable umbrella according to claim 5, wherein said portion of said first strut member is received between said legs of said generally U-shaped channel when said rib is caused to move to an inverted condition of the umbrella

10. An umbrella according to claim 5, further comprising a bracket secured to the radially inner end of each said rib, and wherein, said first strut is pivotally secured to said bracket at said second pivot, and thereby to said rib, said third strut is pivotally secured to said bracket at said sixth pivot, and thereby to said rib, and said U-shaped channel is provided on said bracket at a position between said second and sixth pivots

11. An umbrella according to claim 5, wherein said U-shaped channel has an open end that extends down in the open configuration of the umbrella, for receiving said first strut therein

12. An umbrella according to claim 5, wherein said U-shaped channel is arranged to snugly receive said portion of said first strut also when said umbrella is in a normally open configuration.

13. An umbrella according to claim 5, wherein said third strut is bent downwardly adjacent said sixth pivot to angle said U-shaped channel downwardly to engage said first strut

14. An umbrella according to claim 5, wherein said first strut is bent downwardly adjacent said second pivot to provide a bend therein which is received in said U-shaped channel

15. The foldable umbrella according to claim 1, wherein said U-shaped channel is mounted to said first strut member and has an open end that extends upwardly in the open configuration of the umbrella

16. The foldable umbrella according to claim 15, wherein said U-shaped channel is dimensioned to receive a respective one of said ribs

26 APR 2002

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17. A foldable umbrella according to claim 1, wherein said U-shaped channel is spaced apart from said second pivot with a non-engaging area between said U-shaped channel and said second pivot, said non-engaging area being an area at which said other of said rib and first strut member is not engaged or contacted

18. A foldable umbrella according to claim 1, wherein said portion of said other of said rib and first strut member is received between said legs of said generally U-shaped channel when said rib is caused to move to an inverted condition of the umbrella

19. A foldable umbrella comprising  
a post,  
a stationary hub secured to an upper end of said post,  
at least one canopy centrally secured to said stationary hub,  
a sleeve slidably mounted on said post,  
a plurality of radially oriented ribs secured to said canopy, each said rib having a radially inner end and a radially outward end, and  
a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including  
at least a first strut member having one end portion pivotally connected at a first pivot to said sleeve and a second end portion pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, and  
a generally U-shaped channel mounted to one of said ribs and said first strut member,  
said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post, and  
said generally U-shaped channel having spaced apart legs extending from said one of said rib and said first strut member so as to engage a portion of the other of said rib and first strut member at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut member at least when said rib is caused to move toward an inverted condition of the umbrella, and  
wherein said U-shaped channel is spaced apart from said second pivot with a non-engaging area between said U-shaped channel and said second pivot, said non-engaging area being an area at which said other of said rib and said first strut member is not engaged or contacted

20. A folding umbrella according to claim 19, wherein said generally U-shaped channel is mounted to said rib and has an open end that extends down in the open configuration of the umbrella, for engaging said first strut member

21. A folding umbrella according to claim 19, wherein said generally U-shaped channel is arranged to engage said portion of said other of said rib and first strut member when said umbrella is in a normally open configuration.

22. A folding umbrella according to claim 19, wherein said post is a telescoping post including at least two telescoping post members

23. A foldable umbrella according to claim 19, wherein said U-shaped channel is mounted to said first strut member and has an open end that extends upwardly in the open configuration of the umbrella

24. A foldable umbrella according to claim 19, wherein said U-shaped channel is dimensioned to engage a respective one of said ribs

25. A foldable umbrella according to claim 19, wherein said first strut has a generally U-shaped bend portion for receiving the fifth pivot of the umbrella in the U-shaped bend

26 APR 2002

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portion in a closed configuration of the umbrella so as to enable the umbrella to fold into a more compact configuration

26. A foldable umbrella according to claim 25, wherein said generally U-shaped bend portion is in the vicinity of where said first strut is connected to a rib

27. A foldable umbrella comprising  
a post,  
a stationary hub secured to an upper end of said post,  
at least one canopy centrally secured to said stationary hub,  
a sleeve slidably mounted on said post,  
a plurality of radially oriented ribs secured to said canopy, each said rib having a radially inner end and a radially outward end,  
a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including  
a first strut having one end pivotally connected at a first pivot to said sleeve and a second end pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib,  
a second strut having one end pivotally connected at a third pivot to said stationary hub and a second end pivotally connected at a fourth pivot to an intermediate point of said first strut, and  
a third strut having one end pivotally connected at a fifth pivot to an intermediate point of said second strut and a second end pivotally connected at a sixth pivot to said respective one of said ribs, said sixth pivot being positioned radially inward of said second pivot, and  
a generally U-shaped channel mounted to each said rib, said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post,  
said generally U-shaped channel having spaced apart legs extending from said rib toward said first strut so as to engage a portion of said first strut at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut at least when said rib is caused to move toward an inverted condition of the umbrella, and  
wherein said generally U-shaped channel is spaced apart from said second pivot with a non-engaging area between said U-shaped channel and said second pivot, said non-engaging area being an area at which said first strut is not engaged or contacted

28. A folding umbrella according to claim 27,  
further comprising a bracket secured to the radially inner end of each said rib, and  
wherein  
said first strut is pivotally secured to said bracket at said second pivot, and thereby to said rib,  
said third strut is pivotally secured to said bracket at said sixth pivot, and thereby to said rib, and  
said U-shaped channel is provided on said bracket at a position between said second and sixth pivots

29. A folding umbrella according to claim 27, wherein said U-shaped channel has an open end that extends down in the open configuration of the umbrella, for engaging said first strut.

30. A folding umbrella according to claim 27, wherein said U-shaped channel is arranged to snugly engage said portion of said first strut also when said umbrella is in a normally open configuration

31. A folding umbrella according to claim 27, wherein said third strut is bent downwardly adjacent said sixth pivot to angle said U-shaped channel downwardly to receive said first

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strut therem

32. A folding umbrella according to claim 27, wherein said first strut is bent downwardly adjacent said second pivot to provide a bend therem which engages said U-shaped channel

33. A folding umbrella comprising  
a post,  
at least one canopy coupled to an upper end portion of said post,  
a sleeve slidably mounted on said post,  
a plurality of radially oriented ribs secured to said at least one canopy in equiangularly spaced relation, each said rib having a radially inner end and a radially outward end,  
a plurality of folding strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including  
a first strut having one end portion pivotally connected at a first pivot to said sleeve and a second end portion pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib,  
a second strut having one end portion pivotally connected at a third pivot to said upper end portion of said post and a second end portion pivotally connected at a fourth pivot to an intermediate point of said first strut, and  
a third strut having one end portion pivotally connected at a fifth pivot to an intermediate point of said second strut and a second end portion pivotally connected at a sixth pivot to said respective one of said ribs, said sixth pivot being positioned radially inward of said second pivot, and  
at least one of said first through third struts having a substantially U-shaped bend therem for receiving another part of the umbrella in a closed configuration of the umbrella so as to enable the umbrella to fold into a more compact configuration

34. An umbrella according to claim 33,  
further comprising a bracket secured to said second strut at said intermediate point thereof for pivotally securing said one end of said third strut to said second strut at said fifth pivot, and  
wherein said first strut has said substantially U-shaped bend therem adjacent said fourth pivot, for receiving said bracket in the closed configuration of the umbrella

35. An umbrella according to claim 33, wherein a stationary hub is secured to an upper end portion of said post, and said at least one canopy is coupled to said post via said stationary hub

36. A foldable umbrella comprising  
a post,  
at least one canopy coupled to an upper end portion of said post,  
a sleeve slidably mounted on said post,  
a plurality of radially oriented ribs secured to said at least one canopy, each said rib having a radially inner end and a radially outward end, and  
a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including  
at least a first strut member having one end portion pivotally connected at a first pivot to said sleeve and a second end portion pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, and  
a generally U-shaped channel means mounted to one of said rib and said first strut member, for restraining lateral or sideways movement of said rib relative to said first strut member at least when said rib is caused to move toward an inverted condition of the umbrella,  
said generally U-shaped channel means being at a position near said second pivot and between said second pivot and said post, and

26 APR 2002

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said generally U-shaped channel means having spaced apart legs extending from said one of said rib and said first strut member so as to engage a portion of the other of said rib and first strut member at a position near said second pivot and between said second pivot and said post, to thereby restrain said lateral or sideways movement of said rib relative to said first strut member at least when said rib is caused to move toward an inverted condition of the umbrella, and  
wherein said generally U-shaped channel means is dimensioned to receive said portion of said other of said rib and first strut member between the legs thereof at least at a position spaced from said second pivot and at least when said rib is caused to move toward an inverted condition of the umbrella.

37. An umbrella according to claim 36, wherein said generally U-shaped channel means is mounted to said rib and has an open end that extends down in the open configuration of the umbrella, for engaging said first strut member

38. An umbrella according to claim 36, wherein said generally U-shaped channel means is arranged to receive said portion of said other of said rib and first strut member also when said umbrella is in a normally open configuration

39. An umbrella according to claim 38, wherein said generally U-shaped channel means is dimensioned to snugly receive said portion of said other of said rib and first strut member

40. An umbrella according to claim 36, wherein said generally U-shaped channel means is dimensioned to snugly receive said portion of said other of said rib and first strut member

41. An umbrella according to claim 36, wherein said post is a telescoping post including at least two telescoping post members

42. An umbrella according to claim 36, wherein said generally U-shaped channel means is mounted to said first strut member and has an open end that extends upwardly in the open configuration of the umbrella

43. An umbrella according to claim 42, wherein said generally U-shaped channel means is dimensioned to receive a respective one of said ribs

44. An umbrella according to claim 36, wherein said generally U-shaped channel means is spaced apart from said second pivot with a non-engaging area between said generally U-shaped channel means and said second pivot, said non-engaging area being an area at which said other of said rib and first strut member is not engaged or contacted

45. An umbrella according to claim 36, wherein said portion of said other of said rib and first strut member is received between said legs of said generally U-shaped channel means when said rib is caused to move to an inverted condition of the umbrella

46. An umbrella according to claim 36, wherein a stationary hub is secured to an upper end portion of said post, and said at least one canopy is coupled to said post via said stationary hub

47. A foldable umbrella comprising  
a post,  
at least one canopy coupled to an upper end portion of said post,  
a sleeve slidably mounted on said post,  
a plurality of radially oriented ribs secured to said canopy, each said rib having a radially inner end and a radially outward end,

26 APR 2002

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a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including  
a first strut having one end pivotally connected at a first pivot to said sleeve and a second end pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib,  
a second strut having one end pivotally connected at a third pivot to said upper end portion of said post and a second end pivotally connected at a fourth pivot to an intermediate point of said first strut, and  
a third strut having one end pivotally connected at a fifth pivot to an intermediate point of said second strut and a second end pivotally connected at a sixth pivot to said respective one of said ribs, said sixth pivot being positioned radially inward of said second pivot, and a generally U-shaped channel means mounted to each said rib, for restraining lateral or sideways movement of said rib relative to said first strut at least when said rib is caused to move toward an inverted condition of the umbrella,  
said generally U-shaped channel means being at a position near said second pivot and between said second pivot and said post, and  
said generally U-shaped channel means having spaced apart legs extending from said rib toward said first strut so as to engage a portion of said first strut at a position near said second pivot and between said second pivot and said post, to thereby restrain said lateral or sideways movement of said rib relative to said first strut at least when said rib is caused to move toward an inverted condition of the umbrella, and  
wherein said generally U-shaped channel means is dimensioned to receive said portion of said first strut between the legs thereof at least at a position spaced from said second pivot and at least when said rib is caused to move toward an inverted condition of the umbrella

48. An umbrella according to claim 47,  
further comprising a bracket secured to the radially inner end of each said rib, and  
wherein:  
said first strut is pivotally secured to said bracket at said second pivot, and thereby to  
said rib,  
said third strut is pivotally secured to said bracket at said sixth pivot, and thereby to said  
rib, and  
said generally U-shaped channel means is provided on said bracket at a position  
between said second and sixth pivots

49. An umbrella according to claim 47, wherein said generally U-shaped channel means  
has an open end that extends down in the open configuration of the umbrella, for  
receiving said first strut therein

50. An umbrella according to claim 47, wherein said generally U-shaped channel means  
is arranged to receive said portion of said first strut also when said umbrella is in a  
normally open configuration

51. An umbrella according to claim 50, wherein said generally U-shaped channel means  
is dimensioned to snugly receive said portion of said first strut

52. An umbrella according to claim 47, wherein said generally U-shaped channel means  
is dimensioned to snugly receive said portion of said first strut

53. An umbrella according to claim 47, wherein said third strut is bent downwardly  
adjacent said sixth pivot to angle said generally U-shaped channel means downwardly to  
engage said first strut

54. An umbrella according to claim 47, wherein said first strut is bent downwardly  
adjacent said second pivot to provide a bend therein which is received in said generally

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U-shaped channel means

55. An umbrella according to claim 47, wherein said first strut has a generally U-shaped bend portion for receiving the fifth pivot of the umbrella in the generally U-shaped bend portion in a closed configuration of the umbrella so as to enable the umbrella to fold into a more compact configuration

56. An umbrella according to claim 55, wherein said generally U-shaped bend portion is in the vicinity of where said first strut is connected to a rib

57. An umbrella according to claim 47, wherein said generally U-shaped channel means is spaced apart from said second pivot with a non-engaging area between said generally U-shaped channel means and said second pivot, said non-engaging area being an area at which said first strut is not engaged or contacted

58. An umbrella according to claim 47, wherein a stationary hub is secured to an upper end portion of said post, and said at least one canopy is coupled to said post via said stationary hub

59. A foldable umbrella comprising  
a post,  
at least one canopy coupled to an upper end portion of said post,  
a sleeve slidably mounted on said post,  
a plurality of radially oriented ribs secured to said canopy, each said rib having a radially inner end and a radially outward end, and  
a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including  
at least a first strut member having one end portion pivotally connected at a first pivot to said sleeve and a second end portion pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, and  
a generally U-shaped channel mounted to one of said rib and said first strut member,  
said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post, and  
said generally U-shaped channel having spaced apart legs extending from said one of said rib and said first strut member so as to engage a portion of the other of said rib and said first strut member at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut member at least when said rib is caused to move toward an inverted condition of the umbrella, and  
wherein said generally U-shaped channel is spaced apart from said second pivot with a non-engaging area between said generally U-shaped channel and said second pivot,  
said non-engaging area being an area at which said other of said rib and said first strut member is not engaged or contacted

60. An umbrella according to claim 59, wherein said generally U-shaped channel is mounted to said rib and has an open end that extends down in the open configuration of the umbrella, for engaging said first strut member

61. An umbrella according to claim 59, wherein said generally U-shaped channel is arranged to engage said portion of said other of said rib and first strut member when said umbrella is in a normally open configuration

62. An umbrella according to claim 59, wherein said post is a telescoping post including at least two telescoping post members

63. An umbrella according to claim 59, wherein said generally U-shaped channel is

26 APR 2002

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mounted to said first strut member and has an open end that extends upwardly in the open configuration of the umbrella.

64. An umbrella according to claim 59, wherein said first strut has a generally U-shaped bend portion for receiving the fifth pivot of the umbrella in the generally U-shaped bend portion in a closed configuration of the umbrella so as to enable the umbrella to fold into a more compact configuration.

65. An umbrella according to claim 64, wherein said generally U-shaped bend portion is in the vicinity of where said first strut is connected to a rib.

66. An umbrella according to claim 59, wherein a stationary hub is secured to an upper end portion of said post, and said at least one canopy is coupled to said post via said stationary hub.

67. A foldable umbrella comprising

a post;

at least one canopy coupled to an upper end portion of said post;

a sleeve slidably mounted on said post;

a plurality of radially oriented ribs secured to said canopy, each said rib having a radially

inner end and a radially outward end;

a plurality of foldable strut assemblies, each strut assembly connected between said

sleeve and a respective one of said ribs, each strut assembly including:

a first strut having one end pivotally connected at a first pivot to said sleeve and a second end pivotally connected to a respective one of said ribs at a second pivot spaced radially

outwardly from said radially inner end of the rib,

a second strut having one end pivotally connected at a third pivot to said upper end

portion of said post and a second end pivotally connected at a fourth pivot to an

intermediate point of said first strut, and

a third strut having one end pivotally connected at a fifth pivot to an intermediate point of

said second strut and a second end pivotally connected at a sixth pivot to said respective

one of said ribs, said sixth pivot being positioned radially inward of said second pivot, and

a generally U-shaped channel mounted to each said rib, said generally U-shaped

channel being at a position near said second pivot end between said second pivot and

said post,

said generally U-shaped channel having spaced apart legs extending from said rib

toward said first strut so as to engage a portion of said first strut at a position near said

second pivot and between said second pivot and said post, to restrain lateral or sideways

movement of said rib relative to said first strut at least when said rib is caused to move

toward an inverted condition of the umbrella, and

wherein said generally U-shaped channel is spaced apart from said second pivot with a

non-engaging area between said U-shaped channel and said second pivot, said non-

engaging area being an area at which said first strut is not engaged or contacted

68. An umbrella according to claim 67,

further comprising a bracket secured to the radially inner end of each said rib, and

wherein

said first strut is pivotally secured to said bracket at said second pivot, and thereby to

said rib,

said third strut is pivotally secured to said bracket at said sixth pivot, and thereby to said

rib, and

said generally U-shaped channel is provided on said bracket at a position between said

second and sixth pivots

69. An umbrella according to claim 67, wherein said generally U-shaped channel has an

open end that extends down in the open configuration of the umbrella, for engaging said

26 APR 2002

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first strut

70 An umbrella according to claim 67, wherein said generally U-shaped channel is arranged to snugly engage said portion of said first strut also when said umbrella is in a normally open configuration.

71 An umbrella according to claim 67, wherein said third strut is bent downwardly adjacent said sixth pivot to angle said generally U-shaped channel downwardly to receive said first strut therein

72 An umbrella according to claim 67, wherein said first strut is bent downwardly adjacent said second pivot to provide a bend therein which engages said generally U-shaped channel

73 An umbrella according to claim 67, wherein a stationary hub is secured to an upper end portion of said post, and said at least one canopy is coupled to said post via said stationary hub

74 A foldable umbrella comprising

a post;

at least one canopy coupled to an upper end portion of said post,  
a sleeve slidably mounted on said post,

a plurality of radially oriented ribs secured to said at least one canopy, each said rib having a radially inner end and a radially outward end, and

a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including

at least a first strut member having one end portion pivotally connected at a first pivot to said sleeve and a second end portion pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib, and  
a generally U-shaped channel mounted to one of said rib and said first strut member, said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post,

said generally U-shaped channel having spaced apart legs extending from one of said rib and said first strut member so as to engage a portion of the other of said rib and first strut member at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut member at least when said rib is caused to move toward an inverted condition of the umbrella, and

wherein said generally U-shaped channel is dimensioned to receive said portion of said other of said rib and first strut member between the legs thereof at least at a position spaced from said second pivot and at least when said rib is caused to move toward an inverted condition of the umbrella;

wherein said generally U-shaped channel is mounted to said first strut member and has an open end that extends upwardly in the open configuration of the umbrella

75 A foldable umbrella comprising

a post;

at least one canopy coupled to an upper end portion of said post,

a sleeve slidably mounted on said post,

a plurality of radially oriented ribs secured to said canopy, each said rib having a radially inner end and a radially outward end,

a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including

a first strut having one end pivotally connected at a first pivot to said sleeve and a second end pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib,

26 APR 2002

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a second strut having one end pivotally connected at a third pivot to said upper end portion of said post and a second end pivotally connected at a fourth pivot to an intermediate point of said first strut, and  
a third strut having one end pivotally connected at a fifth pivot to an intermediate point of said second strut and a second end pivotally connected at a sixth pivot to said respective one of said ribs, said sixth pivot being positioned radially inward of said second pivot, and a generally U-shaped channel mounted to each said rib, said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post,  
said generally U-shaped channel having spaced apart legs extending from said rib toward said first strut so as to engage a portion of said first strut at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut at least when said rib is caused to move toward an inverted condition of the umbrella, and  
wherein said generally U-shaped channel is dimensioned to receive said portion of said first strut between the legs thereof at least at a position spaced from said second pivot and at least when said rib is caused to move toward an inverted condition of the umbrella;  
wherein said first strut is bent downwardly adjacent said second pivot to provide a bend therein which is received in said generally U-shaped channel

76. An umbrella according to claim 75, wherein said first strut has a generally U-shaped bend portion for receiving the fifth pivot of the umbrella in the generally U-shaped bend portion in a closed configuration of the umbrella so as to enable the umbrella to fold into a more compact configuration

77. An umbrella according to claim 76, wherein said generally U-shaped bend portion is in the vicinity of where said first strut is connected to a rib

78. A foldable umbrella comprising  
a post,  
at least one canopy coupled to an upper end portion of said post,  
a sleeve slidably mounted on said post,  
a plurality of radially oriented ribs secured to said canopy, each said rib having a radially inner end and a radially outward end,  
a plurality of foldable strut assemblies, each strut assembly connected between said sleeve and a respective one of said ribs, each strut assembly including  
a first strut having one end pivotally connected at a first pivot to said sleeve and a second end pivotally connected to a respective one of said ribs at a second pivot spaced radially outwardly from said radially inner end of the rib,  
a second strut having one end pivotally connected at a third pivot to said upper end portion of said post and a second end pivotally connected at a fourth pivot to an intermediate point of said first strut, and  
a third strut having one end pivotally connected at a fifth pivot to an intermediate point of said second strut and a second end pivotally connected at a sixth pivot to said respective one of said ribs, said sixth pivot being positioned radially inward of said second pivot, and a generally U-shaped channel mounted to each said rib, said generally U-shaped channel being at a position near said second pivot and between said second pivot and said post,  
said generally U-shaped channel having spaced apart legs extending from said rib toward said first strut so as to engage a portion of said first strut at a position near said second pivot and between said second pivot and said post, to restrain lateral or sideways movement of said rib relative to said first strut at least when said rib is caused to move toward an inverted condition of the umbrella, and  
wherein said generally U-shaped channel is dimensioned to receive said portion of said first strut between the legs thereof at least at a position spaced from said second pivot

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and at least when said rib is caused to move toward an inverted condition of the  
umbrella

79 An umbrella substantially as herein described with reference to any embodiment  
shown in the accompanying drawings

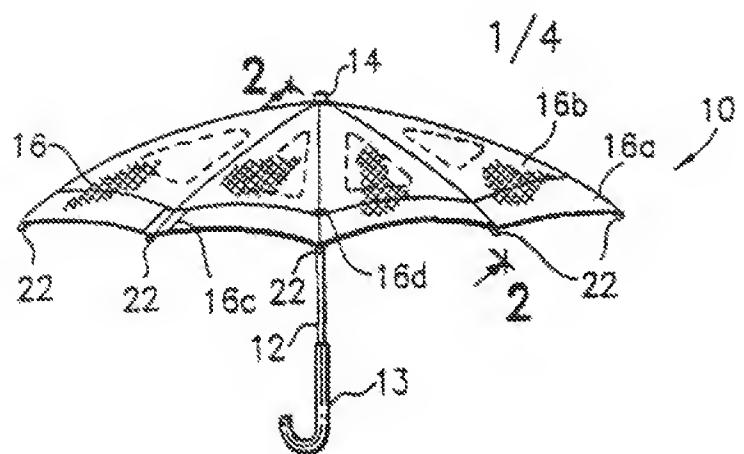


FIG.1

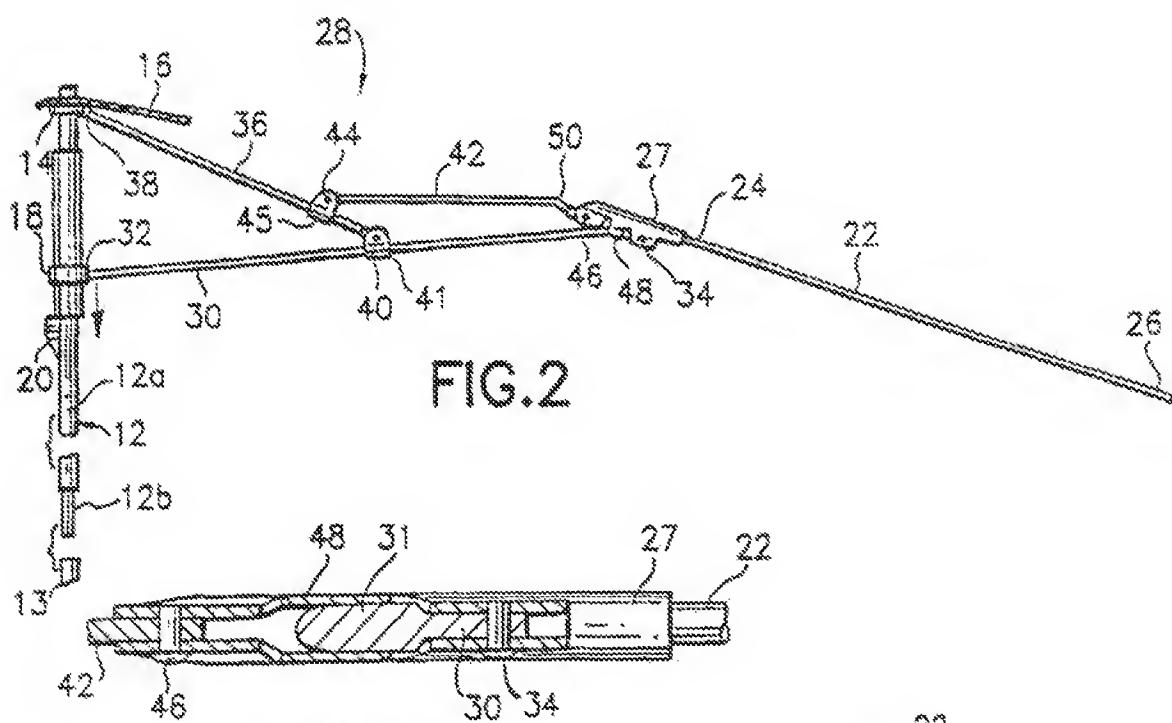


FIG.2

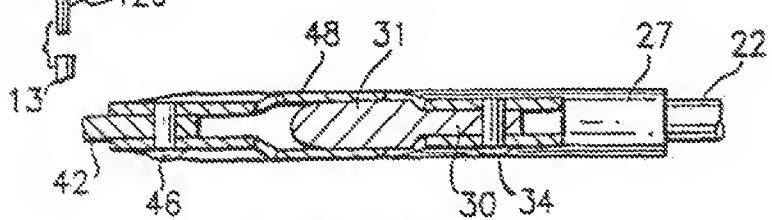


FIG.4

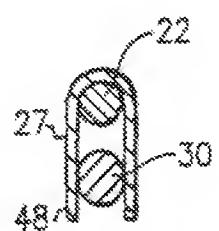


FIG.5

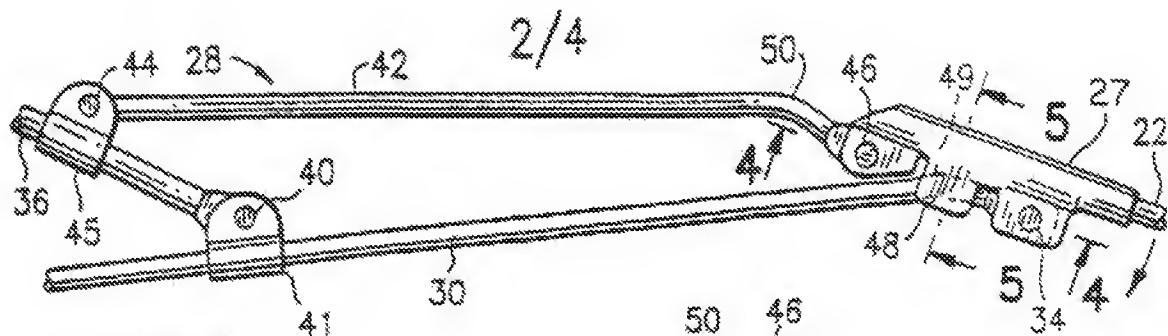


FIG. 3A

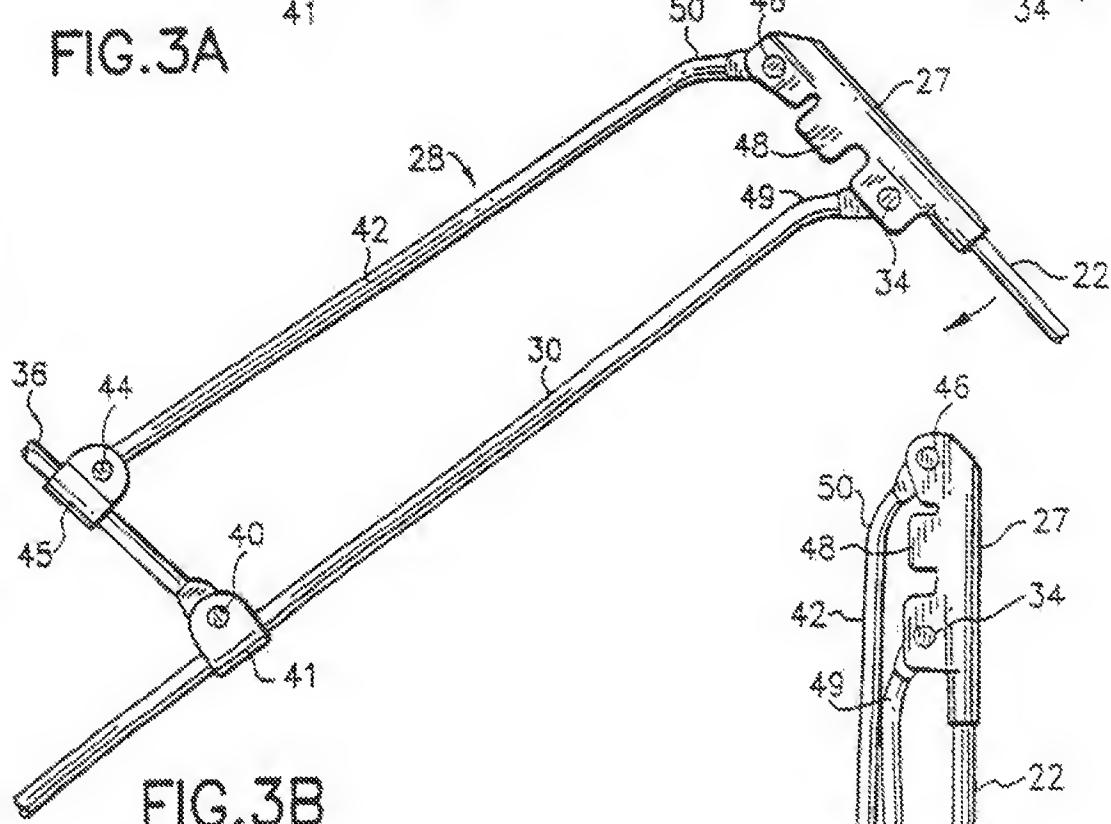


FIG. 3B

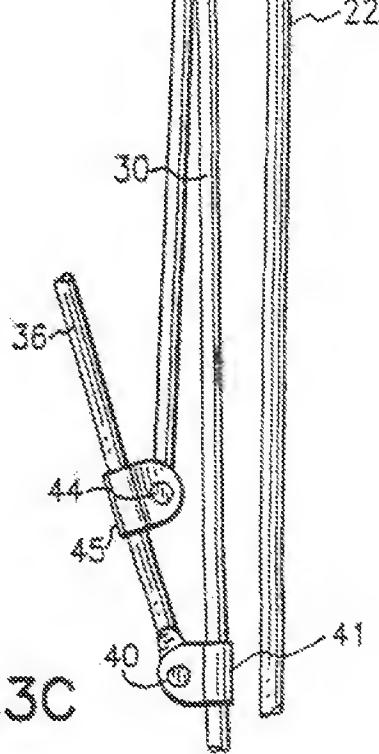
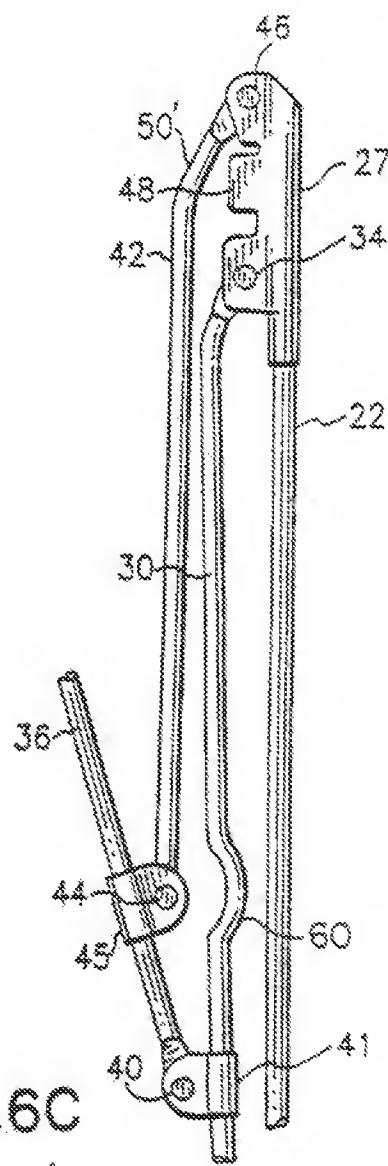
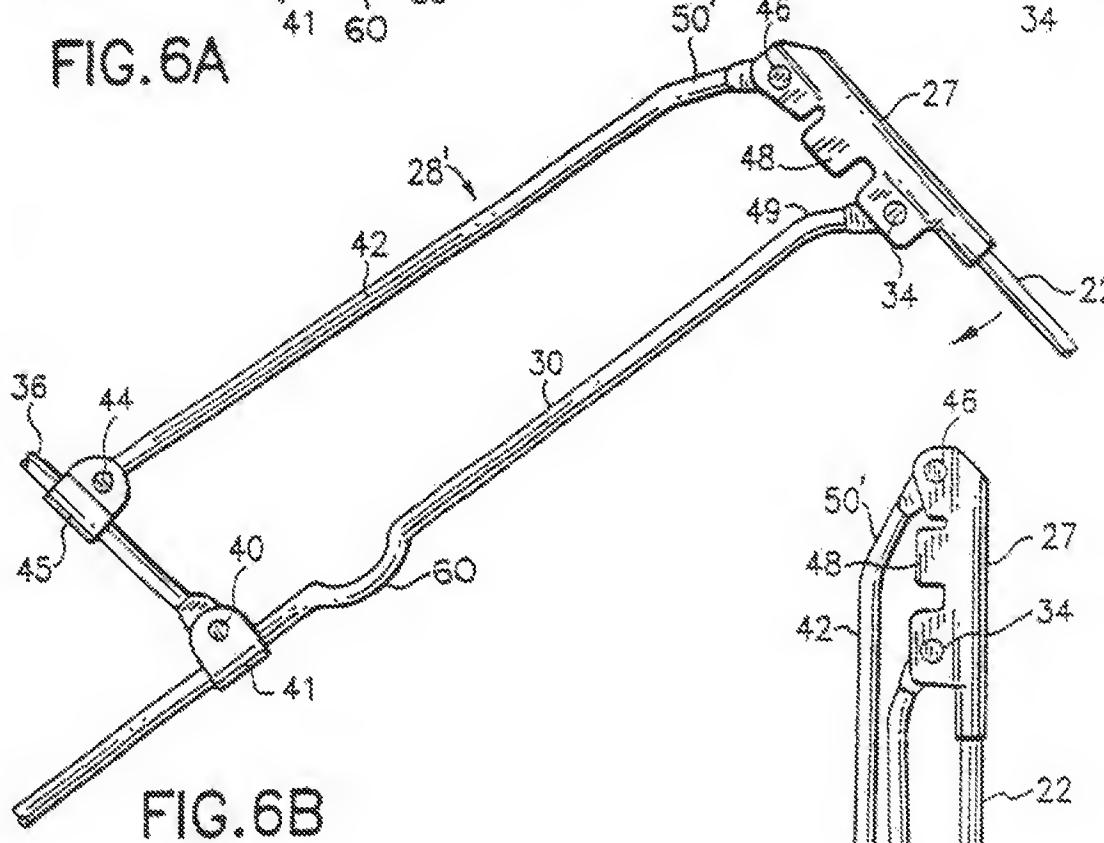
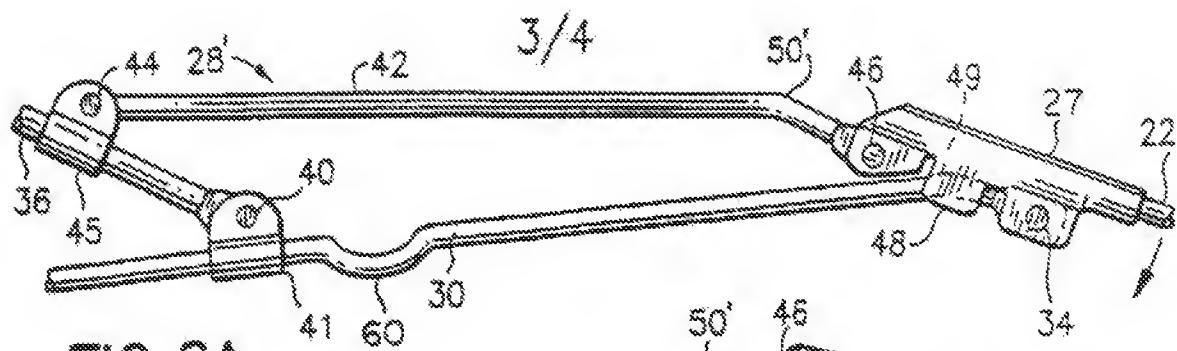
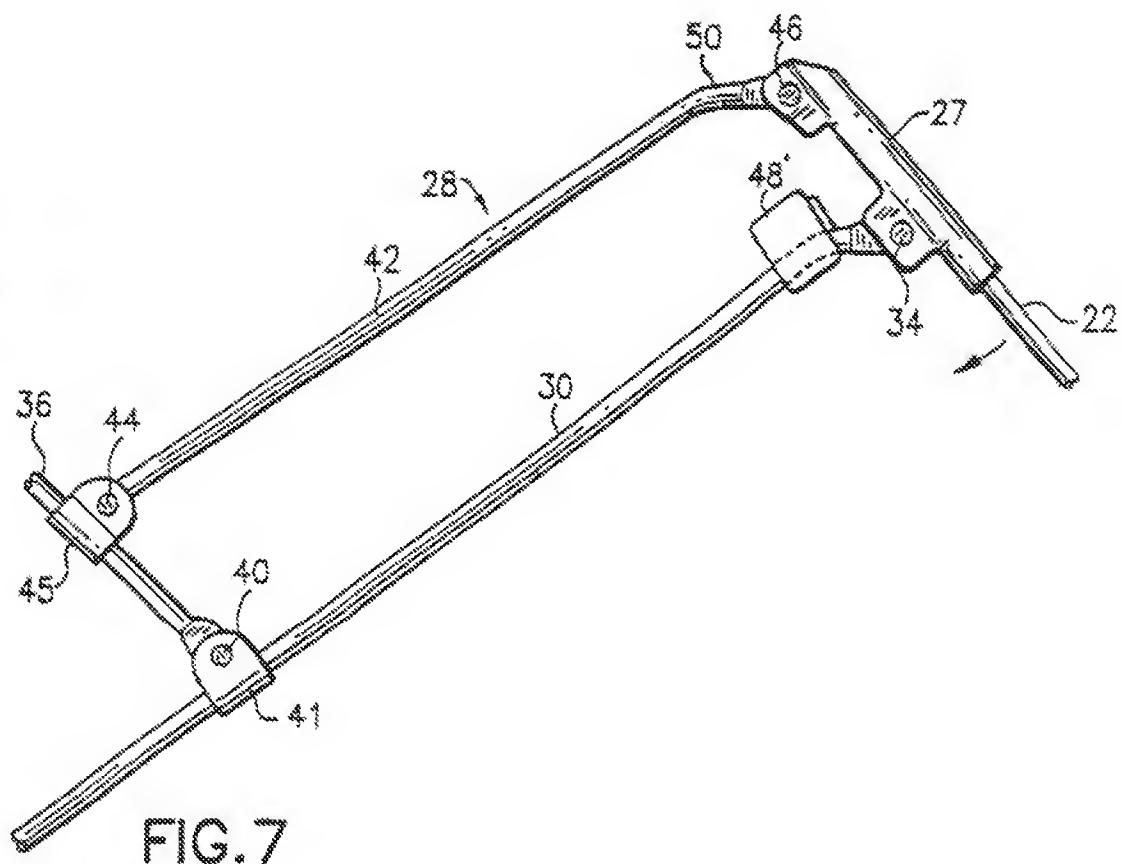


FIG.3C



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END